

*Micrometrical Measures of Double Stars with the 17 $\frac{1}{4}$ -in. Reflector.*  
By the Rev. T. E. Espin, M.A.

I.—*Stars of the Mensuræ Micrometricæ.*

In the following list Column 1 gives the number in  $\Sigma$ , Column 2 the approximate R.A. and Decl. for 1880, Column 3 the position angle, Column 4 the distance, Column 5 the number of nights, Column 6 the magnitudes, Column 7 the date, Column 8 notes.

$\Sigma$	R.A. 1880.	Decl.	P.	D.	Nights.	Mags.	Date.	
	<sup>h</sup>	<sup>m</sup>	<sup>s</sup>	<sup>°</sup>	<sup>'</sup>	<sup>"</sup>		
16	0	10.3	+54	37.24	5.75	3	...	00.99
30		20.7	+49	19	301.20	18.25	3	7.0 8.4 99.98
45		32.1	+46	18	87.25	13.43	2	7.5 9.5 00.60
59		41.2	+50	47	150.87	1.79	2	...
					124.87	34.71	2	$c = 12.2$ 00.38
					160.00	10.40	1	D 12.7 00.87
97	1	5.2	+50	53	97.35	5.05	2	8.9 9.2 99.96
115		15.7	+57	30	148.61	1.15	3	7.0 7.3 01.61
268	2	21.0	+55	0	130.97	2.66	2	6.0 8.0 01.88
270		22.4	+55	1	303.81	20.73	3	...
296		36.0	+48	43	299.74	17.40	3	4.0 10.0 00.36
					223.91	...	2	...
301		39.1	+53	26	16.34	8.05	4	...
314		44.4	+52	30	303.23	1.42	3	6.8 7.0 00.62
331		52.5	+51	52	84.66	11.89	2	...
388	3	20.1	+50	1	206.66	3.00	4	8.2 9.0 01.91
389		20.5	+58	57	63.42	2.56	4	...
390		20.9	+55	2	159.34	14.96	2	5.0 10.0 99.99
396		23.9	+58	22	242.70	20.24	1	...
398		24.6	+57	53	330.10	9.46	1	11.0 11.0 02.08
476		53.6	+38	20	286.46	20.56	2	7.5 8.4 99.94
613	4	50.2	+43	57	104.50	16.63	4	8.2 9.0 00.29
					17.74	15.91	5	11.0 00.25
619		52.1	+50	5	122.72	5.47	3	8.0 8.3 00.35
845	6	2.4	+48	44	353.65	7.90	3	6.0 6.5 00.42
918		24.4	+52	33	327.30	4.73	2	7.0 7.3 00.09
1062	7	13.1	+50	22	315.50	14.59	2	...
1176		58.1	+42	19	28.30	22.29	2	8.3 9.3 00.59

Note 1.

Note 2.

AB motion.

AC. C and D not observed before.

CD.

Increase of distance.

 $\theta$  Persei. AB note.

AC.

Motion in angle.

Motion in angle.

Motion doubtful. Note.

C.P.M.

Note.

Increase of angle and distance.

AB. Note.

AC

Note.

41 Aurigæ.

Increase of angle.

19 Lynceis. Increase of angle.

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*Measures of Double Stars.*

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$\Sigma$		B.A. 1880.	Decl.	P.	D.	Nights.	Mags.	Date.	
		<sup>h</sup>	<sup>m</sup>						
1312	9	18	52 54	147°75	4'28	2	...	01'10	
1321		6.2	+53 12	65°05	18.96	2	7.1 7.5	00 08	Note.
				65.55	18.77	4	...	01'11	
				65.13	18.60	3	...	02 19	
1341		14.3	+51 7	267°44	20.69	3	8.5 8.6	01'11	
1366		27.4	+53 51	323°80	7.88	3	8.0 9.1	02'22	
1368		27.8	+53 51	220°44	21.12	2	8.3 9.6	02'21	
1402		56.8	+56 4	100°60	24.90	2	6.9 7.7	00 12	Note.
1427	10	14.7	+44 30	216°76	9.80	2	7.0 7.2	01'20	
1462		35.6	+51 25	172°28	7.77	2	7.2 9.5	01'65	
1486		47.9	+52 46	101°66	28.86	2	...	00'59	
1495		52.4	+59 35	37°77	34.10	2	6.7 8.4	01'65	
1543	11	22.6	+40 0	2°18	5.26	2	5.0 8.8	02'25	Motion.
1553		30.0	+57 48	166°42	5.00	2	7.3 7.7	02'28	
1572		40.6	+53 58	289°15	10.20	2	8.4 9.2	01'82	
1608	12	5.5	+54 5	223°06	11.91	2	7.5 7.7	01'35	
1630		13.0	+57 2	168°29	2.73	2	9.0 9.2	01'82	
1662		30.2	+57 14	234°95	19.74	2	...	01'82	Motion.
1718	13	0.2	+51 37	272°06	13.21	2	8.8 9.0	01'37	
1758		27.9	+49 45	305°37	4.47	4	7.1 7.2	00'90	Motion.
1821	14	9.2	+52 21	236°78	12.74	2	4.2 8.5	00'93	$\kappa$ Boötis.
1843		20.2	+48 22	186°63	20.35	2	...	01'37	
1909		59.9	+48 7	243°56	4.74	4	7.0 7.2	01'41	Motion.
1984	15	48.0	+53 16	276°93	6.92	4	6.3 8.5	01 17	Motion.
2015	16	5.2	+45 40	158°68	3.24	3	...	01'05	AB.
				96.84	14.21	2	$c=13.2$	01'37	AC. Not seen before, difficult.
2060		26.2	+47 32	255°28	5.34	2	8.7 8.8	01'45	
2063		28.2	+45 51	195°75	16.42	3	5.5 8.1	01'08	
2068		30.5	+47 32	255°28	5.34	2	8.7 8.8	01'45	
2072		32.2	+47 56	180°19	5.46	3	8.6 9.1	01'16	Motion.
2078		33.4	+53 10	109°54	3.48	3	5.0 5.5	01'16	17 Draconis.
				194.52	90.55	2	...	00'44	16 and 17 Draconis
2082		35.5	+49 10	91°11	23.74	4	4.5 9.4	00'71	
2130	17	2.9	+54 37	326°87	2.35	3	5.0 5.2	01'16	$\mu$ Draconis.
2138		7.7	+54 39	135°55	22.32	2	8.0 8.7	00'97	
2271		57.7	+52 51	267°31	2.37	3	6.9 7.8	00'88	
2277	18	0.0	+48 28	121°45	26.91	2	6.5 8.4	01'68	Motion.
2278		0.8	+56 26	24°22	37.04	2	7.0 7.4	00'55	AB.
				147.29	6.32	2	7.7	00'55	BC.

$\Sigma$	$\begin{smallmatrix} \text{R.A. 1880. Decl.} \\ h \quad m \end{smallmatrix}$	P.	D.	Nights.	Mags.	Date.	
2323	$22^{\circ}2' + 58^{\circ} 43'$	$357^{\circ}53'$	$3^{\circ}47'$	2	...	01.16	Motion.
2348	$31^{\circ}2' + 52^{\circ} 16'$	$272^{\circ}23'$	$25^{\circ}42'$	2	5.5 7.8	01.52	
2393	$41^{\circ}1' + 38^{\circ} 12'$	$22^{\circ}70'$	$13^{\circ}56'$	7	7.1 9.6	00.36	Increase of distance.
2433	$54^{\circ}7' + 56^{\circ} 35'$	$125^{\circ}41'$	$7^{\circ}53'$	2	7.2 10.0	01.66	
2463	$19 \quad 2^{\circ}5' + 45^{\circ} 37'$	$4^{\circ}08'$	$9^{\circ}55'$	3	8.5 9.2	01.03	Motion.
2507	$16^{\circ}0' + 44^{\circ} 9'$	$139^{\circ}18'$	$25^{\circ}80'$	2	7.7 9.2	01.74	AB.
		$283^{\circ}80'$	$7^{\circ}14'$	2	10.0	01.74	BC motion? <i>h</i> 's star.
2580	$41^{\circ}9' + 33^{\circ} 27'$	$70^{\circ}90'$	$25^{\circ}59'$	2	...	01.17	$\chi$ Cygni, motion.
2588	$45^{\circ}2' + 44^{\circ} 4'$	$160^{\circ}86'$	$9^{\circ}90'$	2	...	01.72	
2609	$54^{\circ}2' + 37^{\circ} 47'$	$24^{\circ}62'$	$2^{\circ}42'$	3	...	01.60	
2619	$57^{\circ}5' + 47^{\circ} 56'$	$244^{\circ}61'$	$4^{\circ}05'$	2	8.0 8.0	01.63	AB. Note.
		$300^{\circ}24'$	$11^{\circ}03'$	3	13.7	01.64	BC.
		$300^{\circ}15'$	$16^{\circ}72'$	3	12.0	01.81	AD.
		$321^{\circ}09'$	$16^{\circ}48'$	4	...	01.73	BD.
		$164^{\circ}4'$	...	1	...	01.81	DC.
2708	$20 \quad 34^{\circ}1' + 38^{\circ} 13'$	$27^{\circ}40'$	$18^{\circ}63'$	2	7.0 13.5	01.60	AB, Hall's star. Note.
		$330^{\circ}92'$	$27^{\circ}87'$	3	8.5	01.59	AC.
2773	$21 \quad 5^{\circ}8' + 43^{\circ} 32'$	$115^{\circ}95'$	$3^{\circ}41'$	2	8.3 8.7	01.64	
2789	$16^{\circ}7' + 52^{\circ} 28'$	$296^{\circ}10'$	$6^{\circ}01'$	3	7.0 7.1	01.01	
2813	$32^{\circ}4' + 56^{\circ} 56'$	$272^{\circ}27'$	$10^{\circ}29'$	3	8.8 9.0	01.08	
2815	$34^{\circ}0' + 57^{\circ} 1'$	$79^{\circ}76'$	$7^{\circ}32'$	3	7.8 9.5	01.08	
2840	$48^{\circ}0' + 55^{\circ} 14'$	$195^{\circ}66'$	$19^{\circ}71'$	4	6.0 6.5	00.38	
2902	$22 \quad 18^{\circ}5' + 44^{\circ} 45'$	$88^{\circ}07'$	$6^{\circ}07'$	3	7.8 8.1	01.72	
2987	$23 \quad 4^{\circ}8' + 48^{\circ} 22'$	$158^{\circ}98'$	$3^{\circ}60'$	2	7.5 10.0	01.76	
3010	$17^{\circ}7' + 45^{\circ} 8'$	$132^{\circ}26'$	$25^{\circ}65'$	2	8.3 8.6	01.71	AB.
		$103^{\circ}60'$	$29^{\circ}47'$	2	11.5	01.71	AC not seen before.
3034	$38^{\circ}6' + 45^{\circ} 43'$	$101^{\circ}10'$	$6^{\circ}49'$	2	7.8 10.5	00.81	Motion?

## Notes.

1  $\approx$  30. A Proper Motion of  $0''.05$  towards  $265^{\circ}0'$  in the large star will explain the change.

2  $\approx$  45. A Proper Motion of  $0''.064$  towards  $176^{\circ}0'$  is probable.

3  $\approx$  296.  $\theta$  Persei. The motion during the 116 years since Herschel's observation is perfectly rectilinear. I find the following:—

A  $0''.338$  in the direction of  $105^{\circ}6'$

B  $0''.319$  " " "  $100^{\circ}6'$

and all the observations are well represented by

$$\Delta \quad 16''.363 + 0''.029(t - 1866.0)$$

$$P \quad 297^{\circ}.162 + 0^{\circ}.075(t - 1866.0)$$

The star C has no connection with the system.

389. The measures of this star are most discordant. It seems probable that so far there is little if any motion.

398. De. did not measure this star, and it has been generally neglected. It is too faint to be in the B.D. It lies  $33^{\circ} f 2' n$  of B.D. +  $57^{\circ}$ , 729, which has a very faint comes (too faint to measure satisfactorily with the  $17\frac{1}{4}$ -in.).

AB P.  $325^{\circ}46$ . D  $6''88$ . Mags. 8.0 13.5 1902.08.

$\Sigma$  613. A has a Proper Motion of  $0''.047$  towards  $114^{\circ}7$ .

$\Sigma$  619. A change of  $16^{\circ}7$  in angle since  $\Sigma$ .

$\Sigma$  1321. A system like 61 Cygni P.M. A  $1''.711$  towards  $249^{\circ}1$ .

B  $1''.742$  „  $247^{\circ}0$ .

The later observations show that Dunér's formula is correct for position, but makes the distance too large according to recent measures. The following gives closer agreement :

$$\Delta = 19''.721 - 0''.02(t - 1863.0)$$

$$P = 55^{\circ}69 + 0^{\circ}24(t - 1863.0)$$

The star C was first seen 1901 Jan. 22 : it is too faint to measure satisfactorily with the  $17\frac{1}{4}$ -in. A and B are both strong reddish yellow.

$\Sigma$  1402. A has apparent Proper Motion  $0''.07$  towards  $123^{\circ}5$ .

$\Sigma$  2619. The star D was first seen by *h*, and has been measured by O $\Sigma$  and  $\beta$ . The star C was detected by O $\Sigma$ . The comites are difficult to measure with the  $17\frac{1}{4}$ -in. The position-angle DC was obtained by setting the wire parallel with the stars.

$\Sigma$  2708. The star B was detected by Professor Hall, and is called by him 15 mag. It was detected independently with the  $17\frac{1}{4}$ -in. It is too faint to measure properly, but the measures are sufficient to show that the change is due to the Proper Motion of A. The various measures show that A has a Proper Motion of  $0''.26$  towards  $137^{\circ}7$  which is in close agreement with the meridian observations.

## II.—Various Stars.

(C. A. G. refers to stars found double in the catalogue of the *Astronomische Gesellschaft*.)

Names.	R.A. 1880	Decl.	P.	D.	Nights.	Mags.	Date.	Notes.
Espin 40 ...	<sup>h</sup> 0	<sup>m</sup> 51 + <sup>s</sup> 51 24	72°88	3"27	2	8.7 11.7	02.03	AB.
			316°84	23.50	2	10.0	02.03	AC.
Espin 42 ...		16.3 + 52 56	191°28	10.36	3	8.3 9.3	01.90	
O $\Sigma\Sigma$ 7 ...		40.6 + 50 26	76°08	50.59	2	7.5 7.7	01.97	
$\Sigma$ 83 rej. ...		56 5 + 49 40	313°50	22.09	3	7.7 10.4	00.32	<i>h</i> 311°1.
Dawes 8 ...	1	15.3 + 43 11	140°99	2.47	2	8.5 9.0	00.98	No change.
$\Sigma$ 190 rej.		50.8 + 40 48	75°22	24.12	2	8.2 9.2	00.03	Separating from P.M.
<i>h</i> 2136 ...	2	21.0 + 53 19	34°74	5.02	3	8.6 9.2	00.93	<i>h</i> 37°1
Holmes ...	3	20.0 + 59 30	49°94	5.40	3	8.6 10.0	01.62	
O $\Sigma\Sigma$ 37 ...		30.0 + 44 25	95°60	41.23	2	6.5 6.8	01.08	
Espin 55 ...		56.2 + 58 58	261°30	9.01	2	8.1 12.5	01.98	A red.
Hussey 212	4	5.0 + 51 31	192°29	3.66	3	8.9 10.0	01.06	AC found independently.
Goodacre ...		29.0 + 16 16	331°25	3.73	2	11.7 11.7	01.13	Note.
<i>h</i> 2241 ...		48.9 + 47 49	263°14	11.59	3	9.0 9.1	00.66	
C. A. G. ...		52.7 + 54 39	159°99	4.21	2	8.8 9.2	00.56	

Names.		R.A. 1880 Decl.	P.	D.	Nights	Mags.	Date.	Notes.
<i>h</i> 2319 ...	6	24°9' + 47' 52"	305°88'	3°58'	2	9.1 10.7	00.51	AB. <i>h</i> 300°5.
			259°40'	15°81'	2	13.0	00.51	AC.
OΣΣ 78 ...		38°1' + 43' 42"	24°58'	45°39'	4		00.34	Change from PM.
C. A. G. ...		50°8' + 57' 1"	174°28'	6°95'	2	9.1 9.2	00.09	AB.
			3°62'	15°46'	2	14	00.09	AC. Very difficult.
<i>h</i> 2399 ...	7	29°7' + 57' 3"	66°15'	12°26'	2	8.7 11.7	00.09	
Hussey 224?	8	12°6' + 47' 47"	323°10'	3°80'	2	8.0 11.5	01.17	Note.
C. A. G. ...		46°2' + 50' 21"	336°90'	5°44'	2	8.9 9.0	01.21	
<i>h</i> 1176 ...	10	8°6' + 58' 2"	318°50'	8°90'	2	9.0 9.2	02.29	
<i>h</i> 2545 ...		42°0' + 55' 55"	111°11'	18°96'	3	8.8 11.2	02.27	<i>h</i> 116°3.
OΣΣ 109 ...	11	9°1' + 46' 31"	256°83'	79°25'	2	6.9 7.7	02.31	
Σ 1563 rej.		32°8' + 52' 50"	157°10'	13°54'	2	8.6 10.8	02.29	
Espin 73 ...	12	4°3' + 55' 35"	305°81'	3°64'	3	10.5 10.7	01.68	BC.
			20°87'	31°25'	3	8.2	01.67	AB.
<i>h</i> 2617 ...		34°9' + 40' 56"	3°61'	6°24'	2	8.1 8.8	02.31	Motion.
<i>h</i> 2627 ...		52°2' + 48' 7"	132°15'	17°77'	2	8.8 10.9	01.14	
Holmes ...	13	26°8' + 36' 56"	163°43'	7°30'	2	9.1 9.5	01.84	
<i>h</i> 1234 ...		29°3' + 39' 24"	23°38'	33°36'	3	7.5 11.3	02.31	
C. A. G. ...		30°8' + 50' 16"	14°09'	3°30'	3	8.9 9.1	00.41	
			9°19'	3°17'	4		02.30	
<i>h</i> 2700 ...	14	0°8' + 40' 33"	216°23'	22°33'	2	8.7 12.7	00.89	
H <i>h</i> 435 ...		3°8' + 50' 2"	274°20'	81°15'	2	4.7 11.0	02.29	13 Boötis. Note.
<i>h</i> 540 ...		5°4' + 36' 23"	209°84'	9°04'		8.8 9.1	02.32	Note.
Σ I. 26 ...		11°9' + 51' 55"	33°41'	38°12'	2		01.40	1 Boötis.
Espin 19 ...		16°2' + 52' 13"	41°66'	1°62'	3	9.2 10.5	02.32	AB. Very difficult.
			170°38'	41°91'	3	9.3	02.32	AC.
<i>h</i> 2716 ...		18°4' + 46' 55"	85°88'	5°02'	2	9.1 9.3	02.28	
<i>h</i> 2729 ...		26°3' + 56' 39"	56°15'	27°52'	2	8.7 11.0	01.36	
Sh 191 ...		56°0' + 54' 21"	343°15'	40°00'	3	6.6 7.0	00.75	
OΣΣ 137 ...	15	12°2' + 51' 23"	105°82'	74°14'	2	6.1 8.6	00.50	
C. A. G. ...	16	0°6' + 49' 17"	254°81'	8°19'	3	9.3 9.4	00.38	
Ho 412 ...	17	3°8' + 36' 6"	140°42'	19°78'	2	5.0 11.2	00.56	
Σ 2209 rej.		39°2' + 43' 13"	128°06'	29°17'	2	7.7 9.7	00.66	
<i>h</i> 1354 ...	18	48°8' + 36' 17"	5°97'	9°87'	2	8.8 8.9	00.54	<i>h</i> 187°0.
H <i>h</i> 603 ...	19	1°7' + 35' 42"	54°95'	45°52'	1	7.5 8.7	00.57	
Aitken 152.		7°4' + 36' 49"	257°00'	2°71'	3	9.1 9.2	01.58	AB. Note.
			175°00'	20°67'	3	10.3	01.58	AC.

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## Measures of Double Stars.

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Names.		R.A. 1880	Decl.	P.	D.	Nights.	Mags.	Date.	Notes.
	<sup>h</sup>	<sup>m</sup>	<sup>s</sup>						
Hh 605 ...		9.4	+38 50	57.07	39.35	2	7.5 7.8	00.53	
Aitken 157		12.0	+37 10	142.74	2.13	3	9.0 10.0	01.58	Note.
Aitken 158		12.5	+38 58	292.53	3.50	3	8.4 9.7	01.58	Note.
h 1506 ...	20	18.6	+35 18	202.27	9.02	2	8.3 10.5	00.66	AB. h 199°.5.
				192.55	32.67	1	10.3	00.66	AC. h 191° 1.
C. A. G. ...		41.1	+36 20	214.25	6.30	3	9.1 9.2	00.67	
S 786 ...	21	15.8	+52 33	300.40	47.18	3	7.6 9.0	01.01	
h 1709 ...		54.0	+56 1	316.76	9.20	2	8.9 12.0	00.66	h 312°.9.
Hh 764 ...	22	24.1	+57 38	9.81	25.03	2		99.86	P δ Cephei.
C. A. G. ...		27.6	+54 35	333.79	2.86	3	8.7 9.1	01.03	
Dembowski		29.4	+49 46	348.42	7.88	4	8.3 8.4	01.07	
h 1849 ...	23	2.2	+45 43	347.59	47.54	2	4.7 11.0	01.82	4 Andromedæ.
OΣΣ 248 ...		40.8	+50 0	339.40	23.23	1	6.5 12.0	01.83	AB not seen before.
				140.15	53.24	1	9.0	01.83	AC.
Holmes ...		52.4	+57 0	75.86	18.61	2	8.0 11.0	01.92	
Espin 112		53.1	+52 49	221.80	1.33	4	9.0 9.2	01.99	
OΣΣ 254 ...		55.0	+59 43	269.45	58.95	1	7.0 8.5	00.86	

## Notes.

Goodacre. A little pair 62 sec. *p* α Tauri. Place of α Tauri.

Hussey 224. Found independently, and measured before Hussey's results reached me. Hussey makes the star *p* the double, and my angle differs by 10°. It is a very difficult object.

Hh 435. I have failed to find any comes in H's place (82°.6).

h 540. *h* gives (*hMm* 312) 1828.33 30°.18, 14''19, but in his second catalogue the distance is estimated at 6".

Aitken 152, 157, 158. These three stars were all detected and measured before Aitken's results reached me.

The following stars I have been unable to find:

<i>h</i> 2373	...	<sup>h</sup> 7	<sup>m</sup> 15.5 + 56 21	(1880) 00 Jan. 27, Feb. 5.
<i>h</i> 1222	...	12	46.8 + 47 26	„ 02 Apr. 22
Hh 495	...	16	1.2 + 42 20	„ 00 June 8
Hh 635	...	19	40.2 + 37 15	„ 00 July 10
<i>h</i> 1481½	..	20	2.6 + 32 14	„ 00 Sept. 14
Mayer	...	21	4.0 + 52 12	„ 00 Aug. 14
Hh 724	...	21	12.0 + 37 16	„ 00 „ 16
<i>h</i> 1773	...	22	23.4 + 58 17	„ 01 Jan. 5